

NASA SP-7011 (427)  
November 25, 1996

# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and  
Space Administration  
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# Introduction

This issue of *Aerospace Medicine and Biology, A Continuing Bibliography with Indexes* (NASA SP-7011) lists 28 reports, articles, and other documents recently announced in the NASA STI Database.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

Two indexes—subject and author are included.

The NASA CASI price code table, addresses of organizations, and document availability information are located at the back of this issue.

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Selecting an index above will link you to that comprehensive listing.

## Appendix

Select **Appendix** for important information about NASA Scientific and Technical Information (STI) Office products and services, including registration with the NASA Center for AeroSpace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

# Typical Report Citation and Abstract

**DOCUMENT ID NUMBER** → **19960021053** NASA Langley Research Center, Hampton, VA USA. ← **CORPORATE SOURCE**

**TITLE** → **An Extended Compact Tension Specimen for Fatigue Crack Propagation and Fracture**

**AUTHORS** → Piascik, R. S., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; ← **AUTHORS' AFFILIATION**

**PUBLICATION DATE** → Mar. 1996, pp. 16; In English

**CONTRACTS/GRANTS** → Contract(s)/Grant(s): RTOP 538-02-10-01

**REPORT NO.(S)** → Report No.(s): NASA-TM-110243; NAS 1.15:110243; No Copyright; Avail: CASI A03, Hardcopy; A01, Microfiche ← **AVAILABILITY AND PRICE CODE**

**ABSTRACT** → developed for fatigue and fracture testing. Documented herein are stress-intensity factor and compliance expressions for the EC(T) specimen.

**ABSTRACT AUTHOR** → Author

**SUBJECT TERMS** → *Crack Propagation; Stress Intensity Factors; Fatigue (Materials)*

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# AEROSPACE MEDICINE AND BIOLOGY

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*A Continuing Bibliography (Suppl. 427)*

NOVEMBER 25, 1996

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## LIFE SCIENCES (GENERAL)

**19960049584** Wisconsin Univ., Dept. of Zoology; Lab. of Molecular Biology., Madison, WI USA

**Microgravity effects during fertilization, cell division, development, and calcium metabolism in sea urchins** *Final Report*

Schatten, Heide, Wisconsin Univ., USA; Sept. 1996; 4p; In English

Contract(s)/Grant(s): NAG10-0064

Report No.(s): NASA-CR-202245; NAS 1.26:202245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall objectives of this project are to explore the role of microgravity during fertilization, early development, cytoskeletal organization, and skeletal calcium deposition in a model development system: the sea urchin eggs and embryos. While pursuing these objectives, we have also helped to develop, test, and fly the Aquatic Research Facility (ARF) system. Cells were fixed at preselected time points to preserve the structures and organelles of interest with regards to cell biology events during development. The protocols used for the analysis of the results had been developed during the earlier part of this research and were applied for post-flight analysis using light and (immuno)fluorescence microscopy, scanning electron microscopy, and transmission electron microscopy. The structures of interest are: microtubules during fertilization, cell division, and cilia movement; microfilaments during cell surface restructuring and cell division; centrosomes and centrioles during cell division, cell differentiation, and cilia formation and movement; membranes, Golgi, endoplasmic reticulum, mitochondria, and chromosomes at all stages of development; and calcium deposits during spicule formation in late-stage embryos. In addition to further explore aspects important or living in space, several aspects of this research are also aimed at understanding diseases that affect humans on Earth which may be accelerated in space.

Derived from text

*Gravitational Effects; Biological Effects; Cell Division; Sea Urchins; Microgravity; Fertilization; Calcium Metabolism*

**19960049624** Department of the Navy, Washington, DC USA

**Optical Immunoassay for Microbial Analytes Using Non-Specific Dyes**

Ligier, Frances S., Inventor, Department of the Navy, USA; Shriver-Lake, Lisa C., Inventor, Department of the Navy, USA; Wijesuriya, Dayaweera C., Inventor, Department of the Navy, USA; Mar. 05, 1996; 15p; In English; Supersedes US-Patent-Appl-SN-102933, AD-D016056.

Patent Info.: US-Patent-Appl-SN-102933; US-Patent- 5, 496, 700

Report No.(s): AD-D017986; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The presently disclosed invention relates to a method of rapid detection and identification of microorganisms including bacteria, viruses, rickettsiae and fungi. The method involves staining all microorganisms or fragments thereof in a sample. The stained sample is introduced onto an optical waveguide coated with a capture molecule specific for the microorganism of interest, and the bound microorganism or fragment thereof is then optically detected. For example, detection of *B. anthracis* and *Salmonella* was achieved in times of approximately one minute. The sensitivity of this method is on the order of about 3 cells/ul.

DTIC

*Optical Waveguides; Microorganisms; Immunoassay; Detection; Fungi; Bacteria; Salmonella; Viruses*

**19960050016** Nebraska Univ., Medical Center., Omaha, NE USA

**Expression of Recombinant Human Butyrylcholinesterase**

Lockridge, Oksana, Nebraska Univ., USA; Sep. 11, 1995; 71p; In English

Contract(s)/Grant(s): DAMD17-94-J-4005

Report No.(s): AD-A305618; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A mutant of human butyrylcholinesterase, G117H, was expressed in CHO K1 cells. This G117H mutant had the ability to hydrolyze organophosphates including the nerve agents sarin and VX, the pesticide paraoxon, and the drug echothiopate. The rate of paraoxon hydrolysis was accelerated 40,000 fold over the rate by wild-type butyrylcholinesterase. A sec-

ond project to shorten the butyrylcholinesterase protein found that 3 types of deletion were compatible with fully active enzyme: deletion of 40 amino acids from the C-terminus, deletion of 3 carbohydrate attachment sites, and deletion of the interchain disulfide bond at Cys 571. However, deletion of 8 or 59 amino acids from the N-terminus, or deletion of intrachain disulfide bonds yielded inactive enzyme. A third project to understand one of the common genetic variants in the American population, the D7OG mutant of butyrylcholinesterase, studied the steady-state kinetic parameters of mutants D7OG, Q119Y, A277W, G283D and wild-type. It was concluded that Asp 70 was the major component of the peripheral anionic site of butyrylcholinesterase.

DTIC

*Enzymes; Mutations; Genetics; Organic Phosphorus Compounds; Hydrolysis; Amino Acids; Anions; Bonding; Carbohydrates*

**19960050112** Texas Univ., Medical Branch, Dept. of Pathology., Galveston, TX USA

#### **Evaluation of Automated Yeast Identification System**

McGinnis, M. R., Texas Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995.; Aug. 1996, pp. 17-1 - 17-12; In English; Also announced as 19960050110; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

One hundred and nine teleomorphic and anamorphic yeast isolates representing approximately 30 taxa were used to evaluate the accuracy of the Biolog yeast identification system. Isolates derived from nomenclatural types, environmental, and clinical isolates of known identity were tested in the Biolog system. Of the isolates tested, 81 were in the Biolog database. The system correctly identified 40, incorrectly identified 29, and was unable to identify 12. Of the 28 isolates not in the database, 18 were given names, whereas 10 were not. The Biolog yeast identification system is inadequate for the identification of yeasts originating from the environment during space program activities.

Author

*Yeast; Data Bases; Exobiology*

**19960050125** Texas A&M Univ., Dept. of Industrial Engineering., College Station, TX USA

#### **An Intelligent Crop Planning Tool for Controlled Ecological Life Support Systems**

Whitaker, Laura O., Texas A&M Univ., USA; Leon, Jorge, Texas A&M Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995.; Aug. 1996, pp. S-3-1 - S-3-15; In English; Also announced as 19960050110; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a crop planning tool developed for the Controlled Ecological Life Support Systems (CELSS) project which is in the research phases at various NASA facilities. The Crop Planning Tool was developed to assist in the understanding of the long term applications of a CELSS environment. The tool consists of a crop schedule generator as well as a crop schedule simulator. The importance of crop planning tools such as the one developed is discussed. The simulator is outlined in detail while the schedule generator is touched upon briefly. The simulator consists of data inputs, plant and human models, and various other CELSS activity models such as food consumption and waste regeneration. The program inputs such as crew data and crop states are discussed. References are included for all nominal parameters used. Activities including harvesting, planting, plant respiration, and human respiration are discussed using mathematical models. Plans provided to the simulator by the plan generator are evaluated for their 'fitness' to the CELSS environment with an objective function based upon daily reservoir levels. Sample runs of the Crop Planning Tool and future needs for the tool are detailed.

Author

*Farm Crops; Planting; Closed Ecological Systems; Scheduling; Crop Growth; Environment Simulators*

**19960050285** Massachusetts Univ., Dept. of Plant and Soil Sciences., Amherst, MA USA

#### **Design of Plant Gas Exchange Experiments in a Variable Pressure Growth Chamber**

Corey, Kenneth A., Massachusetts Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 18p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Sustainable human presence in extreme environments such as lunar and martian bases will require bioregenerative components to human life support systems where plants are used for generation of oxygen, food, and water. Reduced atmospheric pressures will be used to minimize mass and engineering requirements. Few studies have assessed the metabolic and developmental responses of plants to reduced pressure and varied oxygen atmospheres. The first tests of hypobaric pressures on plant gas exchange and biomass production at the Johnson Space Center will be initiated in January 1996 in the Variable Pressure Growth Chamber (VPGC), a large, closed plant growth chamber rated for 10.2 psi. Experiments were designed and protocols detailed for two complete growouts each of lettuce and wheat to generate a general database for human life support requirements and to answer questions about plant growth processes in reduced pressure and varied oxygen environments. The central objective of crop growth studies in the VPGC is to determine the influence of reduced pressure and reduced oxygen on the rates of photo-



synthesis, dark respiration, evapotranspiration and biomass production of lettuce and wheat. Due to the constraint of one experimental unit, internal controls, called pressure transients, will be used to evaluate rates of CO<sub>2</sub> uptake, O<sub>2</sub> evolution, and H<sub>2</sub>O generation. Pressure transients will give interpretive power to the results of repeated growouts at both reduced and ambient pressures. Other experiments involve the generation of response functions to partial pressures of O<sub>2</sub> and CO<sub>2</sub> and to light intensity. Protocol for determining and calculating rates of gas exchange have been detailed. In order to build these databases and implement the necessary treatment combinations in short time periods, specific requirements for gas injections and removals have been defined. A set of system capability checks will include determination of leakage rates conducted prior to the actual crop growouts. Schedules of experimental events for lettuce and wheat are outlined and include replications in time of diurnal routines, pressure transients, variable pO<sub>2</sub>, pO<sub>2</sub>/pCO<sub>2</sub> ratio, and light intensity responses.

Author

*Gas Exchange; Carbon Dioxide; Oxygen; Pressure Effects; Closed Ecological Systems; Food Production (In Space); Pressure Chambers; Atmospheric Pressure; Crop Growth*

**19960050289** Missouri Univ., Dept. of Mathematics and Computer Science., Saint Louis, MO USA

#### **Constraints in Genetic Programming**

Janikow, Cezary Z., Missouri Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 16p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Genetic programming refers to a class of genetic algorithms utilizing generic representation in the form of program trees. For a particular application, one needs to provide the set of functions, whose compositions determine the space of program structures being evolved, and the set of terminals, which determine the space of specific instances of those programs. The algorithm searches the space for the best program for a given problem, applying evolutionary mechanisms borrowed from nature. Genetic algorithms have shown great capabilities in approximately solving optimization problems which could not be approximated or solved with other methods. Genetic programming extends their capabilities to deal with a broader variety of problems. However, it also extends the size of the search space, which often becomes too large to be effectively searched even by evolutionary methods. Therefore, our objective is to utilize problem constraints, if such can be identified, to restrict this space. In this publication, we propose a generic constraint specification language, powerful enough for a broad class of problem constraints. This language has two elements -- one reduces only the number of program instances, the other reduces both the space of program struc-

tures as well as their instances. With this language, we define the minimal set of complete constraints, and a set of operators guaranteeing offspring validity from valid parents. We also show that these operators are not less efficient than the standard genetic programming operators if one preprocesses the constraints - the necessary mechanisms are identified.

Author

*Genetic Algorithms; Computer Programming; Memory (Computers); Constraints*

## 52 AEROSPACE MEDICINE

*Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.*

**19960048428** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

#### **Modified Model For Transient Response of mRNA Synthesis to Magnetic Field Exposure**

Crosnoe, Timothy W., Air Force Inst. of Tech., USA; Dec. 1995; 85p; In English

Report No.(s): AD-A306063; AFIT/GEE/ENY/95D-01; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

It is a well known fact that high frequency, or radio frequency, radiation can be directly harmful to biological tissue. The radiation frequencies to which humans are most exposed, however, are the extremely low frequencies, or ELF's. to date there has been no definitive measure for predicting the ability of low frequency electromagnetic radiation to cause adverse biological effects. Two specific measures, average magnetic field and kinetic index, have been used in studies to determine if they are useful predictors of adverse effects, specifically leukemia. Unfortunately, both have shown only marginal results. This thesis analyzed and improved the kinetic index measure (Thomas, et al., 1994) by utilizing laboratory biological data to increase the validity of the parameters of an existing model. Then, using this 'improved' model, raw magnetic field exposure data from a previous study was analyzed and compared with the measurement method used in that study (average magnetic field). The results of the model modification showed that accurate modeling of the existing laboratory data could only be accomplished by including an additional parameter to the existing Litovitz multistage model. The results of the model application, however, were not particularly conclusive. The case-control study used for the model application was less than ideal, requiring that more rigorous epidemiological studies be conducted in order to accurately test the improved model.

DTIC

*Biological Effects; Electromagnetic Radiation; Extremely Low Frequencies; Magnetic Fields; Tissues (Biology); Ribonucleic Acids; Radiation Damage*

**19960048474** Navy Experimental Diving Unit, Panama City, FL USA

**Evaluation of the Scubapro MK10 and MK20 SCUBA Regulators for Use In Cold Water**

Clarke, J. R., Navy Experimental Diving Unit, USA; Raione, M., Navy Experimental Diving Unit, USA; Jan. 1996; 14p; In English

Report No.(s): AD-A304487; NEDU-TR-1-96; NAVSEA-TA-95-10; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

NEDU tested the breathing effort and susceptibility to freeze-up of the Scubapro MK10 and MK20 SCUBA regulators. The regulators were tested in 28 F (-2 C) salt water, at depths to 198 fsw (60.7 msw). Five samples of each model were tested. The probability of regulator failure was computed from the number of cold induced incidents, and the time to failure for each incident. Under these rigorous conditions, the probability of failure for the Scubapro MK20 was relatively high, but was lower than in the MK10. There were a large number of high breathing pressure events during the resistive effort measurements in both regulators at a 1500 psi supply pressure. Performance was improved at 500 psi supply pressures. Neither the Scubapro MK10 nor the MK20 is recommended for Navy use in sea water at 28 F and depths to 190 fsw.

DTIC

*Freezing; Probability Theory; High Pressure; Water Depth*

**19960048600** Ministehrstva Akhovy Zdarowya Rehspubliki Belarus, Minsk, Belarus

**The Chernobyl catastrophe consequences in the Republic of Belarus. National report *Posledstviya Chernobyl'skoj katastrofy v Respublike Belarus'. Natsional'nyj doklad***

Konoplya, E. F., Editor, Akademiya Nauk BSSR, Russia; Ro-levich, I.V., Editor, Ministehrstva Akhovy Zdarowya Rehspubliki Belarus, Belarus; Mar. 1996; 96p; In Russian

Report No.(s): INIS-mf-14750; DE96-624056; Copyright; Avail: Issuing Activity (Department of Energy (DOE)) (US Sales Only), Microfiche

The estimation of radioecological, medico-biological, economic and social consequences of the Chernobyl catastrophe has shown that unimaginable damage was incurred on Belarus and its territory became the zone of ecological calamity. The Chernobyl NPP catastrophe has led to the contamination of almost the fourth part of the territory of Belarus where there lived 2.2 million people. The damage caused to the republic by the catastrophe makes up 32 annual budgets of the republic of the pre-accident period in account for the 30-years period for its overcoming. Radioecological situation in Belarus is characterized by complexity and heterogeneous con-

tamination of the territory by different radionuclides and their presence on all the components of the environment. It stipulates the plurality of ways of external and internal irradiation of the population and jeopardizes its health. There is registered the worsening of the population's health, of evacuated and inhabiting the contaminated areas as well, with increase of a number of somatic diseases, including oncological diseases, there are disorders in the metabolic processes and functions of the main systems of the organism. The demographic indices are decreasing. Particular concern causes the children's morbidity growth and genetic consequences of the accident. The contamination of agricultural lands has stipulated in the neighboring the Chernobyl NPP zone the impossibility of their use for food production. On the other lands it has been required to re-profile the farms and create new technologies of the agricultural production. There have been revealed the destructive tendencies in all spheres of the life activity of people who experienced radiation effects. The processes of social adaptation and socio-psychological support of the population require considerable optimization.

DOE

*Radiation Effects; Radioactive Isotopes; Accidents; Belarus; Destruction; Economic Factors; Biological Effects; Contamination; Plutonium; Environment Effects; Pathological Effects*

**19960048698** Alabama Univ., Birmingham, AL USA

**Biodegradable Vaccine Microcapsules for Systemic and Mucosal Immunization against VEE *Final Report, 30 Aug. 1990 - 29 Aug. 1995***

Michalek, Suzzane M., Alabama Univ., USA; Sep. 01, 1995; 19p; In English

Contract(s)/Grant(s): DAMD17-90-C-0113

Report No.(s): AD-A305619; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of this contract effort was to determine the effectiveness of microencapsulated vaccines compared to the conventional vaccines in inducing protective immune responses against challenge with the pathogens Venezuelan equine encephalitis (VEE) virus and *Bacillus anthracis*. The microsphere vaccines were formulated of the biodegradable and biocompatible co-polymer poly(DL-lactide-co-glycolide) (DL-PLG). Formalin-fixed and/or Co-60 inactivated TC-83 VEE virus or protective antigen (PA) of *B. anthracis* was encapsulated in DL-PLG by an emulsion-based process to yield microspheres of approximately 1 to 10 micrometers in diameter and containing approximately 0.8% by weight antigen. Mice immunized by the systemic route with antigen encapsulated in microspheres composed of equal amounts of lactide and glycolide had higher protective immune responses than animals immunized with antigen alone. Vaccine prepared with formalin-fixed virus induced higher responses than untreated virus. Microencapsulated VEE prepared with the solvent methylene chloride compared to ethyl acetate in-

duced higher levels of ELISA antibody activity, neutralization titers, and protection against systemic challenge. However, this relationship depended on the dose of vaccine. Similarly, microencapsulated PA induced higher responses than free antigen and induced the greatest protection against aerosol challenge when given to guinea pigs. Finally, mucosal, especially intratracheal, immunization with microencapsulated VEE induced systemic and mucosal responses and protection against aerosol challenge.

DTIC

*Vaccines; Immunology; Encephalitis; Cobalt 60; Bacillus; Biodegradability; Ethyl Compounds; Physiological Responses; Microparticles; Viruses; Antigens*

**19960049780** Army Aeromedical Research Lab., Fort Rucker, AL USA

**U.S. Army Aviation Epidemiology Data Register. Population Demographics and Aeromedical Disqualifications among Female US Army Flight Surgeons and Aeromedical Physician Assistants for Calendar Years 1986 to 1995 Final Report**

Mason, Kevin T., Army Aeromedical Research Lab., USA; Bryce, Michelle H., Army Aeromedical Research Lab., USA; Mar. 1996; 13p; In English

Contract(s)/Grant(s): Army Proj. 30162787A878O

Report No.(s): AD-A306468; USAARL-96-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This was a descriptive study to meet the short-notice requirements of the U.S. Army Aero-medical Center in support of the upcoming Women in Army Aviation Symposium in February 1996. Analysis of available data in the Aviation Epidemiology Data Register and school records at the U.S. Army School of Aviation Medicine provided a better understanding of the age distribution, numbers, retention, and aeromedical disposition outcomes of female Army flight surgeons and aeromedical physician assistants for the period 1986 to 1995. Seven data tables are provided to summarize the findings. Among a cohort of 141 applicants, 107 attended the Army Flight Surgeon Primary Course, Aeromedical physician assistant applicants were just as likely as flight surgeons to attend the U.S. Army Flight Surgeon Primary Course (Relative risk (Katz) = 1.06, CI(0.95) = 0.81, 1.39) Many attending the course required a waiver for their medical disqualifications (42.1%) . Flight surgeons were more likely than aeromedical physician assistants to require a waiver, but not significantly (Relative risk (Katz) = 2.75, CI(0.95) = 0.76, 9.91).

DTIC

*Aerospace Medicine; Epidemiology; Females; Flight Surgeons*

**19960049789** Naval Postgraduate School, Monterey, CA USA

**Numerical and Experimental Study of Failure of the Human Proximal Femur**

VanCourt, Ronald R., Naval Postgraduate School, USA; Kwon, Young W., Naval Postgraduate School, USA; Mar. 1996; 72p; In English

Report No.(s): AD-A306477; NPS-ME-96-003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Static and dynamic experiments were conducted to study the failure loads and fracture patterns of human proximal femur bones, that are intact and core drilled. This was done to assist orthopedic surgeons better understand the effects of core drilling into the femoral head to remove osteonecrosis. Unlike previous studies, where only static tests were conducted, dynamic tests were performed to better simulate a lateral fall. A Finite Element Analysis (FEA) was also completed to understand stress distributions in the proximal femur when subjected to static and dynamic loads. Previous PEA models of the femur analyzed static loads only with just a core drilled hole at the lesser trochanter. This PEA model examines various sizes of hole diameters and locations on the greater trochanter as well as having the model loaded statically and dynamically.

DTIC

*Femur; Finite Element Method; Orthopedics; Biodynamics; Stress (Physiology); Fracturing; Loads (Forces)*

**19960049790** Army Aeromedical Research Lab., Fort Rucker, AL USA

**U.S. Army Aviation Epidemiology Data Register: Rates of Exceptions to Policy Granted to Medically Disqualified U.S. Army Aviator Students from Fiscal Year 1986 to Fiscal Year 1990 Final Report**

Mason, Kevin T., Army Aeromedical Research Lab., USA; Mar. 1996; 11p; In English

Contract(s)/Grant(s): Army Proj. 30162787A878

Report No.(s): AD-A306470; USAARL-96-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. Army Aviation Epidemiology Data Register and U.S. Army Aviation Center flight training school records were queried to determine the medical diagnosis, rank, and service component of those who entered aviator training with an exception to policy. The study period was fiscal years 1986 to 1990, five years. The exception to policy rates granted to medically disqualified U.S. Army aviator students before or upon entry into flight training is unknown. Sample case histories were discussed. The overall exception to policy rate was 1.45 exceptions to policy per 100 aviator student starts per fiscal year. Commissioned officer students had a significantly better chance of being granted an exception to policy (relative risk (Katz) = 2.24, CI(0.95) = 1.54, 3.26). No component of service had an advantage over the others for being granted an exception to policy. Exceptions to policy most often were granted for refractive error, hearing loss, anthropometry, and orthopedic conditions of the extremities.

DTIC

**19960050118** Louisiana Tech Univ., College of Engineering and Sciences., Ruston, LA USA

**Dextroamphetamine: a pharmacologic countermeasure for space motion sickness and orthostatic dysfunction**

Snow, L. Dale, Louisiana Tech Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995.; Aug. 1996, pp. 23-1 - 23-13; In English; Also announced as 19960050110; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Dextroamphetamine has potential as a pharmacologic agent for the alleviation of two common health effects associated with microgravity. As an adjuvant to Space Motion Sickness (SMS) medication, dextroamphetamine can enhance treatment efficacy by reducing undesirable Central Nervous System (CNS) side effects of SMS medications. Secondly, dextroamphetamine may be useful for the prevention of symptoms of post-mission orthostatic intolerance caused by cardiovascular deconditioning during spaceflight. There is interest in developing an intranasal delivery form of dextroamphetamine for use as a countermeasure in microgravity conditions. Development of this dosage form will require an analytical detection method with sensitivity in the low ng range (1 to 100 ng/mL). During the 1995 Summer Faculty Fellowship Program, two analytical methods were developed and evaluated for their suitability as quantitative procedures for dextroamphetamine in studies of product stability, bioavailability assessment, and pharmacokinetic evaluation. In developing some of the analytical methods, beta-phenylethylamine, a primary amine structurally similar to dextroamphetamine, was used. The first analytical procedure to be evaluated involved hexane extraction and subsequent fluorescence labeling of beta-phenylethylamine. The second analytical procedure to be evaluated involved quantitation of dextroamphetamine by an Enzyme-Linked Immunosorbent Assay (ELISA).

Author (revised)

*Aerospace Medicine; Motion Sickness; Pharmacology*

**19960050279** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX USA

**Characterization of Microgravity Effects on Bone Structure and Strength Using Fractal Analysis**

Acharya, Raj S., State Univ. of New York, USA; Shackelford, Linda, NASA Johnson Space Center, USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 16p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Protecting humans against extreme environmental conditions requires a thorough understanding of the pathophysiological changes resulting from the exposure to those extreme conditions. Knowledge of the degree of medical risk associated with the exposure is of paramount importance in the design of effective prophylactic and therapeutic measures for space exploration. Major health hazards due to musculoskeletal systems include the signs and symptoms of hypercalciuria, lengthy recovery of lost bone tissue after flight, the possibility of irreversible trabecular bone loss, the possible effect of calcification in the soft tissues, and the possible increase in fracture potential. In this research, we characterize the trabecular structure with the aid of fractal analysis. Our research to relate local trabecular structural information to microgravity conditions is an important initial step in understanding the effect of microgravity and countermeasures on bone condition and strength. The proposed research is also closely linked with Osteoporosis and will benefit the general population.

Author

*Gravitational Effects; Microgravity; Bone Demineralization; Fractals; Bones; Mathematical Models*

**19960050281** Arkansas Univ., Dept. of Applied Sciences., Little Rock, AR USA

**Predictive Modeling of Cardiac Ischemia**

Anderson, Gary T., Arkansas Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 12p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The goal of the Contextual Alarms Management System (CALMS) project is to develop sophisticated models to predict the onset of clinical cardiac ischemia before it occurs. The system will continuously monitor cardiac patients and set off an alarm when they appear about to suffer an ischemic episode. The models take as inputs information from patient history and combine it with continuously updated information extracted from blood pressure, oxygen saturation and ECG lines. Expert system, statistical, neural network and rough set methodologies are then used to forecast the onset of clinical ischemia before it transpires, thus allowing early intervention aimed at preventing morbid complications from occurring. The models will differ from previous attempts by including combinations of continuous and discrete inputs. A commercial medical instrumentation and software company has invested funds in the project with a goal of commercialization of the technology. The end product will be a system that analyzes physiologic parameters and produces an alarm when myocardial ischemia is present. If proven feasible, a CALMS-based system will be added to existing heart monitoring hardware.

Author

*Prediction Analysis Techniques; Heart Diseases; Ischemia; Warning Systems; Medical Equipment; Bioinstrumentation*

**19960050288** Texas A&M Univ., Dept. of Mechanical Engineering., College Station, TX USA

**Trabecular Bone Mechanical Properties and Fractal Dimension**

Hogan, Harry A., Texas A&M Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 14p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Countermeasures for reducing bone loss and muscle atrophy due to extended exposure to the microgravity environment of space are continuing to be developed and improved. An important component of this effort is finite element modeling of the lower extremity and spinal column. These models will permit analysis and evaluation specific to each individual and thereby provide more efficient and effective exercise protocols. Inflight countermeasures and post-flight rehabilitation can then be customized and targeted on a case-by-case basis. Recent Summer Faculty Fellowship participants have focused upon finite element mesh generation, muscle force estimation, and fractal calculations of trabecular bone microstructure. Methods have been developed for generating the three-dimensional geometry of the femur from serial section magnetic resonance images (MRI). The use of MRI as an imaging modality avoids excessive exposure to radiation associated with X-ray based methods. These images can also detect trabecular bone microstructure and architecture. The goal of the current research is to determine the degree to which the fractal dimension of trabecular architecture can be used to predict the mechanical properties of trabecular bone tissue. The elastic modulus and the ultimate strength (or strain) can then be estimated from non-invasive, non-radiating imaging and incorporated into the finite element models to more accurately represent the bone tissue of each individual of interest. Trabecular bone specimens from the proximal tibia are being studied in this first phase of the work. Detailed protocols and procedures have been developed for carrying test specimens through all of the steps of a multi-faceted test program. The test program begins with MRI and X-ray imaging of the whole bones before excising a smaller workpiece from the proximal tibia region. High resolution MRI scans are then made and the piece further cut into slabs (roughly 1 cm thick). The slabs are X-rayed again and also scanned using dual-energy X-ray absorptiometry (DEXA). Cube specimens are then cut from the slabs and tested mechanically in compression. Correlations between mechanical properties and fractal dimension will then be examined to assess and quantify the predictive capability of the fractal calculations.

Author

*Fractals; Mathematical Models; Finite Element Method;*

*Gravitational Effects; Grid Generation (Mathematics); Computational Grids; Magnetic Resonance; Imaging Techniques; Image Analysis; Tissues (Biology); X Ray Imagery*

**19960050342** Iowa Univ., Iowa City, IA USA

**Lateral parabrachial serotonergic mechanisms: Angiotensin-induced pressor and drinking responses**

Menani, Jose Vanderlei, Iowa Univ., USA; Johnson, Alan Kim, Paulista State Univ., Brazil; May 15, 1995; ISSN 0369-6119; 8p; Repr. from American Physiological Society, 1995 R1044-R1049; In English

Contract(s)/Grant(s): NAGW-4358

Report No.(s): NASA-CR-201811; NAS 1.26:201811; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

This study investigated the effects of bilateral injections of serotonergic receptor ligands into the lateral parabrachial nucleus (LPBN) on the pressor and dipsogenic responses induced by intracerebroventricular (icv) injection of angiotensin 2 (ANG 2). Rats with stainless steel cannulas implanted bilaterally into the LPBN and into the left lateral ventricle were used to study icv ANG2-induced water intake and pressor responses. Pretreatment with the serotonergic 5-HT(sub 1)/5-HT(sub 2) receptor antagonist methysergide (1-8 (mu)g/200 nl) bilaterally injected into the LPBN increased the water intake induced by icv ANG 2 (50 ng/(mu)l) administered via the lateral ventricle, but pretreatment with methysergide (4 (mu)g/200 nl) did not change the pressor response produced by icv ANG 2. After bilateral injection of either serotonin (5-HT, 5 (mu)g/200 nl) or the serotonergic 5-HT(sub 2a)/5-HT(sub 2c) receptor agonist (+/-)2,5-dimethoxy 4-iodoamphetamine hydrochloride (DOI; 0.5-10 (mu)g/200 nl) into the LPBN, the water intake induced by ANG 2 was significantly reduced. These results are consistent with other observations indicating that the LPBN is associated with inhibitory mechanisms controlling water intake induced by ANG 2 treatment and suggest that serotonergic pathways may be involved in this effect.

Author

*Drinking; Vasoconstrictor Drugs; Ligands; Physiological Responses; Cannulae; Cardiac Ventricles*

**19960050382** California Univ., San Diego, CA USA

**[Volume Homeostasis and Renal Function in Rats Exposed to Simulated and Actual Microgravity] Final Report**

Tucker, Bryan J., California Univ., USA; Apr. 13, 1993; 18p; In English

Contract(s)/Grant(s): NAG2-659

Report No.(s): NASA-CR-202187; NAS 1.26:202187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project has investigated mechanisms that influence alterations in compartmental fluid and electrolyte balance in microgravity and evaluates countermeasures to control renal

fluid and electrolyte losses. Determining the alterations due to space flight in fluid compartments and renal function is an important component in understanding long term adaptation to spaceflight and the contribution to post-flight orthostatic intolerance. Four definition phase studies and two studies examining neuro-humoral and vascular mechanisms have been completed.

Derived from text

*Adaptation; Renal Function; Space Flight; Microgravity; Electrolytes; Orthostatic Tolerance; Gravitational Effects; Physiological Responses; Biological Effects*

**19960050517** Civil Aeromedical Inst., Oklahoma City, OK USA

**A Further Validation of the Practical Color Vision Test for En Route Air Traffic Control Applicants *Final Report***

Mertens, H. W., Civil Aeromedical Inst., USA; Milburn, N. J., Civil Aeromedical Inst., USA; Collins, W. E., Civil Aeromedical Inst., USA; Aug. 1996; 14p; In English  
Report No.(s): DOT/FAA/AM-96/22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Flight Progress Strips Test (FPST) is currently used for secondary color vision screening of applicants for air traffic control jobs at en route centers. The test provides a practical, job-specific color vision selection criterion involving use of color coding in the most important color task of en route radar controllers, i.e., discrimination of the non-redundant color coding in flight progress strips (FPSs). This experiment provides a further, independent validation of the FPST using a new criterion test. Prediction by the FPST of performance on the new and old criterion tests was compared. Subjects were classified as normal or deficient based on anomaloscope readings. The pass/fail cutoff score for all tests was 'pass with no more than one error.' All people with normal color vision passed. Over all, for participants with both normal and abnormal color vision, the correlations between error scores on the FPST and both criterion tests were greater than  $r = .93$ , and error scores tended to increase with degree of color vision deficiency. The validity of the FPST was  $Kappa = .86$  for prediction of performance on the new criterion test, as compared to .91 for prediction of performance on the original criterion test. Part of that small decrease in validity may be because of application of the same pass/fail cutoff score to the new criterion test, which contains a larger number of items than the FPST. The predictive validity of the FPST was shown to be acceptably high in this further validation with a new, independent set of actual flight progress strips as the criterion test.

Author

*Visual Perception; Color Vision; Air Traffic Controllers (Personnel); Human Performance; Performance Prediction*

**MAN/SYSTEM TECHNOLOGY  
AND LIFE SUPPORT**

*Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.*

**19960048693** Galaxy Scientific Corp., Atlanta, GA USA  
**Human Factors in Aviation Maintenance, Phase 5 *Final Report - Progress, Apr. 1994 - Mar. 1995***

Shepherd, William T., Galaxy Scientific Corp., USA; Jan. 1996; 285p; In English; Limited Reproducibility: More than 20% of this document may be affected by microfiche quality  
Contract(s)/Grant(s): DTFA01-94-C-01013

Report No.(s): AD-A304262; DOT/FAA/AM-96/2; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The fifth phase of research on human factors in aviation maintenance continued to look at the human's role in the aviation maintenance system via investigations, demonstrations, and evaluations of the research program outputs. This report describes the following areas: (Ch. 2) PENS mobile computing software for FAA inspectors; (Ch. 3) STAR computer-based training for aviation regulations; (Ch. 4) HIS digital documentation systems, a hypertext multimedia software system; (Ch. 5) software/hardware distribution on the Internet; (Ch. 6) human factors program reviewing human performance issues associated with inspection; (Ch. 7) human factors audit program providing a valid tool for evaluating human factors in maintenance tasks; (Ch. 8) a study of how the design of workcards affects their use and the subsequent potential for error; (Ch. 9) the process of visual inspection and evaluation measuring visual inspection performance; (Ch. 10) a battery of mechanical aptitude tests, a simulated NDI task, and the ability of the tests to predict performance; (Ch. 11) the results of a report on an evaluation of a teamwork training program in a FAR 147 school; and (Ch. 12) ARAC rule changes and impending rule changes.

DTIC

*Aircraft Maintenance; Human Factors Engineering; Human Performance; Training Evaluation; Inspection; Computer Systems Programs*

**19960050100** Department of the Navy, Washington, DC USA

**Inflatable Life Vest**

Heath, Cleveland A., Inventor, Department of the Navy, USA; Roy, Maurice W., Inventor, Department of the Navy, USA; Feb. 27, 1996; 7p; In English; Supersedes US-Patent-Appl-SN-316709, AD-D017273.

Patent Info.: US-Patent-Appl-SN-316709; US-Patent-5, 494, 469

Report No.(s): AD-D018014; No Copyright; Avail: US Patent

and Trademark Office, Microfiche

An inflatable life vest comprises two sheets of polymeric material. The edges of these sheets are sealed to form an inner cavity with a plurality of discrete, inflatable chambers disposed in a U-shaped pattern to define collar and chest portions of the life vest. A manifold connects to an inflation source and has a plurality of openings. A check valve connects each manifold opening with one of the chambers to permit inflation medium flow into the chamber and to block inflation medium flow outwardly from a chamber into the manifold. This construction isolates the chambers from one another so the rupture of one chamber does not affect the ability of the other chambers to be buoyant.

DTIC

*Vests; Safety Devices; Buoyancy*

**19960050113** Texas A&M Univ., Engineering and Technology Dept., College Station, TX USA

**A human factors analysis of EVA time requirements**

Pate, D. W., Texas A&M Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995.; Aug. 1996, pp. 18-1 - 18-12; In English; Also announced as 19960050110; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Human Factors Engineering (HFE), also known as Ergonomics, is a discipline whose goal is to engineer a safer, more efficient interface between humans and machines. HFE makes use of a wide range of tools and techniques to fulfill this goal. One of these tools is known as motion and time study, a technique used to develop time standards for given tasks. A human factors motion and time study was initiated with the goal of developing a database of EVA task times and a method of utilizing the database to predict how long an Extravehicular Activity (EVA) should take. Initial development relied on the EVA activities performed during the STS-61 mission (Hubble repair). The first step of the analysis was to become familiar with EVAs and with the previous studies and documents produced on EVAs. After reviewing these documents, an initial set of task primitives and task time modifiers was developed. Videotaped footage of STS-61 EVAs were analyzed using these primitives and task time modifiers. Data for two entire EVA missions and portions of several others, each with two EVA astronauts, was collected for analysis. Feedback from the analysis of the data will be used to further refine the primitives and task time modifiers used. Analysis of variance techniques for categorical data will be used to determine which factors may, individually or by interactions, effect the primitive times and how much of an effect they have.

Author

*Human Factors Engineering; Human-Computer Interface; Safety Factors; Time Functions*

**19960050283** Rice Univ., Mechanical Engineering and Materials Science., Houston, TX USA

**Materials Assessment of Components of the Extravehicular Mobility Unit**

Olivas, John D., Rice Univ., USA; Barrera, Enrique V., Rice Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 12p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Current research interests for Extravehicular Mobility Unit (EMU) design and development are directed toward enhancements of the Shuttle EMU, implementation of the Mark 3 technology for Shuttle applications, and development of a next generation suit (the X suit) which has applications for prolonged space flight, longer extravehicular activity (EVA), and Moon and Mars missions. In this research project two principal components of the EMU were studied from the vantage point of the materials and their design criteria. An investigation of the flexible materials which make up the lay-up of materials for abrasion and tear protection, thermal insulation, pressure restraint, etc. was initiated. A central focus was on the thermal insulation. A vacuum apparatus for measuring the flexibility of the materials was built to access their durability in vacuum. Plans are to include a Residual Gas Analyzer on the vacuum chamber to measure volatiles during the durability testing. These tests will more accurately simulate space conditions and provide information which has not been available on the materials currently used on the EMU. Durability testing of the aluminized mylar with a nylon scrim showed that the material strength varied in the machine and transverse directions. Study of components of the EMU also included a study of the EMU Bearing Assemblies as to materials selection, engineered materials, use of coatings and flammability issues. A comprehensive analysis of the performance of the current design, which is a stainless steel assembly, was conducted and use of titanium alloys or engineered alloy systems and coatings was investigated. The friction and wear properties are of interest as are the general manufacturing costs. Recognizing that the bearing assembly is subject to an oxygen environment, all currently used materials as well as titanium and engineered alloys were evaluated as to their flammability. An aim of the project is to provide weight reduction since bearing weights constitute 1/3 of the total EMU weight. Our investigations have shown favorable properties using a titanium or nickel base alloy in conjunction with a coating system. Interest lies in developing titanium as a more nonflammable material. Methodology for doing this lies in adding coatings and surface alloying the titanium. This report is brief and does not give all necessary details. The reader should contact the authors as to the detailed study and for viewing of raw data.

Author

*Extravehicular Mobility Units; Thermal Insulation; Durability; Stainless Steels; Titanium Alloys; Flexibility; Wear Resistance; Flammability*

**19960050293** Texas A&M Univ., Engineering Technology and Industrial Engineering., College Station, TX USA

**Intelligent Planning and Scheduling for Controlled Life Support Systems**

Leon, V. Jorge, Texas A&M Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program: 1995; Aug. 1996; vol. 1; 16p; In English; Also announced as 19960050278; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Planning in Controlled Ecological Life Support Systems (CELSS) requires special look ahead capabilities due to the complex and long-term dynamic behavior of biological systems. This project characterizes the behavior of CELSS, identifies the requirements of intelligent planning systems for CELSS, proposes the decomposition of the planning task into short-term and long-term planning, and studies the crop scheduling problem as an initial approach to long-term planning. CELSS is studied in the realm of Chaos. The amount of biomass in the system is modeled using a bounded quadratic iterator. The results suggests that closed ecological systems can exhibit periodic behavior when imposed external or artificial control. The main characteristics of CELSS from the planning and scheduling perspective are discussed and requirements for planning systems are given. Crop scheduling problem is identified as an important component of the required long-term lookahead capabilities of a CELSS planner. The main characteristics of crop scheduling are described and a model is proposed to represent the problem. A surrogate measure of the probability of survival is developed. The measure reflects the absolute deviation of the vital reservoir levels from their nominal values. The solution space is generated using a probability distribution which captures both knowledge about the system and the current state of affairs at each decision epoch. This probability distribution is used in the context of an evolution paradigm. The concepts developed serve as the basis for the development of a simple crop scheduling tool which is used to demonstrate its usefulness in the design and operation of CELSS.

Author

*Closed Ecological Systems; Control Systems Design; Scheduling; Planning; Crop Growth*

**19960050423** Institute of Sound and Vibration Research, Southampton, UK

**Transmission of Mechanical Vibration through the Human Body to the Head**

Paddan, G. S., Institute of Sound and Vibration Research, UK; Griffin, M. J., Institute of Sound and Vibration Research, UK; Aug. 1996; 170p; In English

Report No.(s): ISVR-TR-260; Copyright; Avail: Issuing Activity (Inst. of Sound and Vibration Research, Univ. of Southampton, Southampton S09 5NH, England), Hardcopy, Microfiche

A series of laboratory studies has investigated the transmission of vibration through the body to the heads of seated and standing persons. Subjects were exposed to random vibration of a seat or a floor at frequencies up to 25 Hz in single axes (fore-and-aft, lateral, vertical, roll, pitch or yaw) while vibration was measured at the head in all six axes using a bite-bar held between the teeth. For each condition, the variability within subjects and between subjects is presented. Fore-and-aft and vertical seat vibration mainly resulted in head motion in the mid-sagittal plane; the head motion increased when there was contact between a subject's back and the seat backrest. Lateral seat vibration mainly resulted in lateral head motion which was not greatly affected by backrest contact. Vibration of the head depended on the location of measurement on the head; for example, during exposure to vertical seat vibration, fore-and-aft motion at the top of the head was more than four times greater than fore-and-aft motion at the chin; similarly, vertical head motion varied with fore-and-aft position on the head. Motion at the head occurred mostly in the lateral, roll and yaw axes during exposure to roll seat vibration, and in the fore-and-aft, vertical and pitch axes during exposure to pitch seat vibration. There was less head motion when there was no contact with the backrest. During roll vibration of the seat, vertical and pitch head motion were least when the centre of rotation was in the subject's mid-sagittal plane; roll head motion decreased as the position of the centre of rotation was raised from below the seat surface to above the seat surface. Varying the centre of rotation (along the fore-and-aft and vertical axes) during pitch seat vibration altered head motion in the mid-sagittal plane: head motion increased with increasing distance of the centre of rotation in front or behind the subject and increased as the seat was raised from below the centre of rotation to above the centre of rotation. The effects of holding on to a handrail, foot separation and bending of the legs on the transmission of translational floor vibration to the heads of standing subjects were investigated. With fore-and-aft floor vibration, head motion occurred mostly in the mid-sagittal plane; a rigid grip on a handrail increased head motion. With lateral floor vibration, the head motion occurred mainly below 3 Hz and in the lateral axis; a 60 cm foot separation resulted in more head motion below 3 Hz than narrower separations. Vertical floor vibration mainly caused head motion in the mid-sagittal plane; for frequencies below about 5 Hz, a legs bent posture resulted in the highest transmissibilities, while a legs locked posture showed the lowest motion; this order was reversed at higher frequencies.

Author

*Posture; Pitching Moments; Random Vibration; Sitting Position; Vertical Motion; Vibration; Head Movement; Acceleration Stresses (Physiology)*



**55**  
**SPACE BIOLOGY**

*Includes exobiology; planetary biology; and extraterrestrial life.*

**19960048399** NASA Ames Research Center, Moffett Field, CA USA

**Life Into Space: Space Life Sciences Experiments. NASA Ames Research Center 1965-1990**

Souza, Kenneth, Editor, NASA Ames Research Center, USA;  
Hogan, Robert, Editor, NASA Ames Research Center, USA;  
Ballard, Rodney, Editor, NASA Ames Research Center, USA;  
Jul. 1995; 622p; In English

Contract(s)/Grant(s): RTOP 106-10-00

Report No.(s): NASA-RP-1372; A-950021; NAS 1.61:1372;  
No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Life into Space contains a top-level summary of space life science mission results from nonhuman experiments developed and/or managed by the NASA Ames Research Center over the 25 year period 1965-1990. The book describes accomplishments by: many scientists, engineers, and managers at NASA Ames; scientists within the large university community that supports NASA life sciences research objectives, many international specialists, and aerospace industry hardware development and support contractors. A compilation of this information is unavailable in any other single source. The contents include overviews of all missions, research objectives, payload descriptions, experiment development, mission operations and results. Excerpts from interviews with specialists associated with several missions are also included. A description of the international space agencies with which NASA Ames conducts cooperative space life sciences activities is provided. Three major appendices are included which describe over 200 experiments and their results, related flight hardware with illustrations, related publications, and a detailed subject and author index. Life into Space can serve as a valuable reference for scientists, engineers, and managers involved in Space Life Sciences research as well as educators and students interested in the results.

Author

*Life Sciences; Payloads; Experiment Design; Space Missions; Research Management; Gravitational Effects; Aerospace Environments*

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